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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/530,548	04/07/2005	Junichi Onozaki	P27628	7630
7055	7590	04/27/2006	EXAMINER	
GREENBLUM & BERNSTEIN, P.L.C. 1950 ROLAND CLARKE PLACE RESTON, VA 20191			BEVERIDGE, RACHEL E	
			ART UNIT	PAPER NUMBER
			1725	

DATE MAILED: 04/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/530,548

Applicant(s)

ONOZAKI ET AL.

Examiner

Rachel E. Beveridge

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 07 April 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) 9-15 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☒ Claim(s) 1-15 are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 April 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 07/08/2005.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Election/Restrictions*

The restriction requirement as set forth in the Office action mailed on March 15, 2006 is hereby withdrawn. However, applicant's arguments with regard to the previous restriction requirement are moot in view of the new grounds for restriction.

Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

Group I, claim(s) 1-8, drawn to solder supplying and solder bump forming methods.

Group II, claim(s) 9-15, drawn to a solder bump forming apparatus.

The special technical feature of Group I is a substrate with its surface facing up in a liquid which is heated to be hotter than a melting point of solder and dropping solder fine particles made of the solder being melted on the substrate in the liquid, as recited in Claim 1. The forgoing special technical feature is shown in the prior art of U.S. Patent 6,070,788 (Zakel). Therefore, there is no contribution made over the prior art, hence there is no unity of invention and lack of unity is held by the Examiner.

A telephone call was not made to request an oral election to the above restriction requirement, but did not result in an election being made.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a species or invention to be examined even though the requirement be traversed (37 CFR 1.143) and (ii) identification of the claims encompassing the elected invention.

The election of an invention or species may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse.

Should applicant traverse on the ground that the inventions or species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions or species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C.103(a) of the other invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

### ***Drawings***

Figure 4 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct

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any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: reference number 12 (specification, p. 17). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: Figure 1, reference numbers 2, 11a, and 11b. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each

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drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-5 and 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Zakel (US 6,070,788).

With respect to claim 1, Zakel discloses a solder layer on a solder screen inside a medium and "above" the substrate, "where the application of the solder onto the terminal faces is effected in a sedimentary manner by means of a screen discharge consisting of solder particles" (col. 3, lines 7-11). Zakel further discloses the sedimentary precipitation of the solder particles on the terminal faces also enables a wetting of irregular surfaces (col. 3, lines 11-14). Zakel's figures 3a to 3c show a method in which a solder layer (16) is disposed on a solder screen (15) in the bath (11), which is tempered to a temperature above the melting temperature of the highest-melting solder component (col. 5, lines 34-38). Zakel teaches discharging a screen of

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solder particles (17) via gravity through the bath (11) onto the surface of the substrate (12) disposed below the solder screen (15) in the bath (11) (FIG. 3b) (col. 5, lines 39-42). Moreover, Zakel discloses the formation of solder bumps (14) from the sediment-like deposits of the solder particles (17) on the pads (13) (col. 5, lines 46-48). Zakel teaches the use of liquid organic substances, such as mineral oil or paraffin, and discloses the importance at a specific soldering temperature for a specific substance used as a medium to have a temperature equal to or above the melting temperature of the highest-melting solder component and that it is particularly advantageous to tune the pairing of solder components and medium in a suitable manner to one another (col. 4, lines 37-44).

Regarding claim 2, Zakel discloses selective soldering on a substrate having wettable and non-wettable sub-surfaces so that there is adhesion of the solder material only on the wettable surfaces so that the solder material in the medium is not repelled by the non-wettable sub-surfaces (col. 2, lines 30-35). Furthermore, Zakel teaches that the respective wettability of the sub-surfaces may be adjusted for example by means of a suitable surface design (col. 2, lines 35-37). Zakel applies a solder resist onto the substrate surfaces and leaves wettable sub-surfaces exposed (col. 2, lines 39-41). Also, Zakel discloses thickening of the solder bumps via "solder reflow" in the region of the pads (13), while at the same time the remaining surface regions of the substrate (12) repel the remaining molten solder particles which collect at the bottom (113) of the bath (11) (col. 6, lines 39-46).

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With regard to claim 3, Zakel teaches discharging a screen of solder particles (17) via gravity through the bath (11) onto the surface of the substrate (12) disposed below the solder screen (15) in the bath (11) (FIG. 3b) (col. 5, lines 39-42). Therefore, by a forced "plunge" or a gravitational drop, it is implied that there is a "specific range" within with the particle falls (col. 5, lines 38-48).

Regarding claim 4, Zakel discloses a solder layer on a solder screen inside a medium and "above" the substrate, "where the application of the solder onto the terminal faces is effected in a sedimentary manner by means of a screen discharge consisting of solder particles" (col. 3, lines 7-11). Zakel further discloses the sedimentary precipitation of the solder particles on the terminal faces also enables a wetting of irregular surfaces (col. 3, lines 11-14). Zakel's figures 3a to 3c show a method in which a solder layer (16) is disposed on a solder screen (15) in the bath (11), which is tempered to a temperature above the melting temperature of the highest-melting solder component (col. 5, lines 34-38). Zakel teaches discharging a screen of solder particles (17) via gravity through the bath (11) onto the surface of the substrate (12) disposed below the solder screen (15) in the bath (11) (FIG. 3b) (col. 5, lines 39-42). Moreover, Zakel discloses the formation of solder bumps (14) from the sediment-like deposits of the solder particles (17) on the pads (13) (col. 5, lines 46-48). Zakel teaches the use of liquid organic substances, such as mineral oil or paraffin, and discloses the importance at a specific soldering temperature for a specific substance used as a medium to have a temperature equal to or above the melting temperature of the highest-melting solder component and that it is particularly advantageous to tune



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the pairing of solder components and medium in a suitable manner to one another (col. 4, lines 37-44).

With respect to claim 5, Zakel discloses tempering of the medium to boiling temperature it is ensured that there is a homogenous temperature distribution in the bath, resulting in the formation of a correspondingly fine-grained, homogeneous structure of the solder alloy (col. 4, lines 17-22).

With regard to claim 7, Zakel teaches a medium that creates an inert environment which enables a re-melting of the solder components into an alloy in a reductive environment (col. 4, lines 2-4). Zakel also discloses the use of liquid organic substances, such as mineral oil or paraffin, and discloses the importance at a specific soldering temperature for a specific substance used as a medium to have a temperature equal to or above the melting temperature of the highest-melting solder component and that it is particularly advantageous to tune the pairing of solder components and medium in a suitable manner to one another (col. 4, lines 37-44). The examiner notes that the medium of glycerol utilized by Zakel is an organic fatty acid.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zakel (US 6,070,788) as applied to claim 4 above, and further in view of Degani et al. (US 5,125,560).

Zakel teaches a medium that creates an inert environment, which enables a re-melting of the solder components into an alloy in a reductive environment (Zakel, col. 4, lines 2-4). However, Zakel lacks disclosure of the inert liquid specifically containing a flux for the same purpose. Degani discloses utilizing fluxes in a vehicle such as polyethylene glycol with an organic acid such as rosin or abietic acid (Degani, et al., col. 2, lines 41-46). Furthermore, Degani discloses the flux being a vehicle and an acid, where the vehicle is typically a liquid solvent (col. 3, lines 38-39). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the invention of Zakel to include the disclosure of Degani in order to produce removal of the oxide from the solder bump at reflow temperature (Degani et al., col. 3, lines 39-42).

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zakel (US 6,070,788) as applied to claim 4 above, and further in view of Schwiebert et al. (US 5,880,017).

Zakel discloses the surface of a substrate (12) having a solder bump distribution (27) of individual, meniscus-like solder bumps (14), which have been formed by wetting on the circular pads (Zakel, col. 6, lines 47-51). See figure 6. Zakel lacks disclosure of the dimensions of each solder bump with relation to the distance between each bump or pad on the substrate. Figure 1B of Schwiebert shows the diameter (D) of the solder

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bump is smaller than the distance (p) between each solder bumps center. Furthermore, Schwiebert discloses creating fine pitches corresponding to the center-to-center distance between each wettable pad (Schwiebert et al., col. 5, lines 4-7). Schwiebert's table (col. 5-6) shows that the distance (p) is always greater than the diameter (D) in three different examples. Also, Schwiebert lists many properties and their specific formula's for the dimensions and spacing of the solder bumps on the substrate (col. 5-6). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the invention of Zakel to include the spacing requirements of Schwiebert in order to form an efficient flip-chip because of its small size and smallest interconnect option (Schwiebert et al., col. 1, lines 42-44) and further to obtain a low cost, high volume method of producing and assembling integrated circuits (Schwiebert et al., col. 1, lines 20-23).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rachel E. Beveridge whose telephone number is 571-272-5169. The examiner can normally be reached on Monday through Friday, 9 am to 6 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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JONATHAN JOHNSON  
PRIMARY EXAMINER